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EXTENSIVE INVENTORY OF FOREST RESOURCES BY MULTISTAGE SAMPLING

GSFC Identification Number 2306A

Contract Number S-54053A

Report date - December 28, 1976

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STATEMENT OF PROBLEMS:

1. On December 16, a letter was sent to G. R. Stonesifer, Contracting Officer, requesting an extension of the contract to May 1, 1977. Reasons given were: (1) disruption of the work because of a transfer of Remote Sensing functions from Berkeley, California to Fort Collins, Colorado and, (2) delays in obtaining required LANDSAT data.

ACCOMPLISHMENTS:

Photo Interpretation, Mapping, and Photogrammetry:

1. Preliminary analysis of the county water resource survey data indicates that although two out of the three county estimates showed a gain in sampling efficiency using stratified random sampling (table 1), the gain in efficiency was too small to be significant. Standard errors of the means by county, ranged from 8.1 to 9.4 percent at the 67 percent confidence level (1 S.D.).

When water data for individual counties were combined, the standard error of the sample mean was greater for stratified random sampling than for simple random sampling. We concluded from this that under the conditions defined by this study, prestratification of water populations on LANDSAT photographic data does not reduce population variation. This does not mean, however, that improved definitions for water strata and better LANDSAT photo data will not allow improved classification and reduce the within and between strata variation. Regardless of this, LANDSAT is a useful base for defining and enumerating the total population units for random sample selections.

Total length of waterways and area of surface water in the three sample counties have been computed (table 2). When compared with Bureau of Census statistics, the difference in total surface water area derived from the LANDSAT survey shows the amount of noncensus water in the counties.

Additional information has been derived for each county from detailed interpretation of high altitude CIR photographs and 7½-minute USGS quadrangles. Information includes lengths of streams and surface water areas by size, by utility, and by accessibility classes.

Table 1. Mean length of waterways and mean surface water area per square kilometer by county, with standard errors of the means for both stratified and simple random sampling.

County	Length of Waterways[1]			Surface Water Area[2]		
	Sample Cell Mean	Standard Error[3] Stratified	Random	Sample Cell Mean	Standard Error Stratified	Random
	Meters			Hectares		
King George	705.6	±66.7	±54.6	3.2	±1.9	±0.8
Lancaster	713.3	±57.7	±62.4	10.6	±1.3	±1.5
Northumberland	737.3	±60.4	±62.1	22.5	±2.4	±1.5
Combined Counties	695.7	±52.8	±51.7	--	--	--

1/ Rivers, streams, estuaries, canals, sloughs

2/ Reservoirs, lakes and ponds, and estuaries, sloughs, and rivers over 100-meters wide.

3/ One standard deviation (67 percent probability level).

4/ A sample cell is 1-square kilometer.

Table 2. Area of water defined by Bureau of Census compared with surface water area defined by LANDSAT stratified sample: three counties.

County	Open Water[1/]	Surface Water[2/]	Difference[3/]	
	Bureau of Census	LANDSAT	Noncensus Water	Percent
	Hectares			
King George	1161	1741	+530	50.0
Lancaster	4146	5629	+1483	35.8
Northumberland	8551	13860	+5309	62.1

1/ Includes streams, rivers, sloughs, and estuaries more than 1/8 of a statute mile wide and lakes, reservoirs, and ponds over 40 acres in size.

2/ Includes all measurable water area.

3/ The difference is water in streams less than 1/8 mile wide, and lakes, reservoirs, and ponds less than 40 acres in area.

2. The forest resource survey has been completed for seven of nine counties. Summaries have been made for LANDSAT and CIR photo data for the seven counties and the data punched for computer processing.

3. A field trip will be made to the Virginia site sometime in January. Water utility classifications made by photo interpretation on CIR photographs will be checked. Also, relationships will be established between ground cover classification anomalies and LANDSAT spectral data.

Computer Analysis, Mapping, and Photogrammetry:

1. Use of the Lawrence Berkeley Laboratory (LBL) computer facility has been re-established. The programs previously developed to run there can now be utilized in our LANDSAT study.

2. The spectral clustering work has been continued using empirical distributions derived from radiance value histograms. By January 1st a version of the ISOCLAS spectral clustering program may be operational on local facilities. In this event, the data will be reclustered using ISOCLAS and compared with the empirical distribution clusters and the defined information classes. Training sets will be selected and the subsequent sampling, supervised classification, and analysis procedures will be as outlined in previous reports.

3. A computer mask has been generated which will allow all pixels in the test area to be identified by county for sampling, generation of county statistics, and in-place mapping for checking classification accuracy.

ACCOMPLISHMENTS

Data Standardization and Quantification:

1. The LANDSAT tapes for coverage of the Virginia site on April 19 and 20, 1976 arrived at the end of this reporting period. We are beginning to print out gray-scale maps of selected portions of these scenes to locate the five sites covered with radiance measurements by Forest Service aircraft flights. Four sites are cloud-free, but one coastal site has a thin overcast on an eastern portion.

2. Time corrections were performed on ground irradiance data acquired on April 20 and on two subsequent days of aircraft coverage. It was necessary to correct for the time required to scan the spectral region of 440 to 1180 nanometers and record data from the circular variable filter spectrometer. Adjustment of the diffuse sky radiation scans (taken with the irradiance probe shaded), to values appropriate to the times of the total irradiance scans, was also performed. Corrections were also made to find irradiance values at the precise times of the aircraft and overflight.

Integrations of ground spectral data, weighted by the LANDSAT MSS spectral responses, were computed to compare with irradiance data taken on board the aircraft. Perliminary results show that, for most bands,